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Indian Standard

RESIDUAL CURRENT-OPERATED PROTECTIVE DEVICES (RCDs) FOR HOUSEHOLD AND SIMILAR USE—ELECTROMAGNETIC COMPATIBILITY

ICS No. 29.120.50; 97.120

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

October 1998

Price Group 4

Low Voltage Switchgear and Controlgear Sectional Committee, ET 07

NATIONAL FOREWORD

This Indian Standard which is identical to IEC 1543 (1995) 'Residual current-operated protective devices (RCDs) for household and similar use—Electromagnetic compatibility' issued by the International Electrotechnical Commission was adopted by the Bureau of Indian Standards on the recommendations of the Low Voltage Switchgear and Controlgear Sectional Committee (ET 07) and approval of the Electrotechnical Division Council.

The text of the IEC standard has been approved as suitable for publication as Indian Standard without deviations.

This standard includes definitions, standard electromagnetic conditions, conditions of operation in service and electromagnetic tests necessary for devices providing residual current protection. It is intended to apply in conjunction with present and future Indian Standards on residual current devices incorporating overcurrent protection.

In the adopted standard, certain terminology and conventions are not identical with those used in Indian Standards. Attention is specially drawn to the following:

a) Wherever the words 'International Standard' appear, referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standard, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their place are listed below along with their degree of equivalence:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 1000-4-2 : 1995 Electromagnetic compatibility—Part 4: Testing and measurement techniques—Section 2: Electrostatic discharge immunity test—Basic EMC publication	Nil	—
IEC 1000-4-4 : 1995 Electromagnetic compatibility—Part 4: Testing and measurement techniques—Section 4:Electrical fast transient/burst immunity test—Basic EMC publication	Nil	—
IEC 1000-2-2 : 1990 Electromagnetic compatibility—Part 2: Environment—Section 2: Compatibility levels for low frequency conducted disturbances and signalling in public low voltage power supply systems	Nil	—
IEC 1000-4-1 : 1992 Electromagnetic compatibility—Part 4: Testing and measurement techniques—Section 1: Overview of immunity test—Basic EMC publication	Nil	—

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IS 14614 : 1998
IEC 1543 (1995)

Indian Standard

RESIDUAL CURRENT-OPERATED PROTECTIVE DEVICES (RCDs) FOR HOUSEHOLD AND SIMILAR USE—ELECTROMAGNETIC COMPATIBILITY

1 Scope

This International Standard is intended to ensure electromagnetic compatibility (EMC) of devices providing residual current protection, for rated voltages not exceeding 440 V a.c., intended principally for protection of persons against shock hazards.

This standard applies for environmental conditions which occur in installations connected to low-voltage public networks or similar. It may also provide guidance for ensuring EMC for other products intended for safety purposes or for products including electronic circuits and for which a high level of continuity of service is required.

For EMC test requirements not included in the product standards reference should be made to this product family standard.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 1000-4-2: 1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test – Basic EMC publication*

IEC 1000-4-4: 1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test – Basic EMC publication*

IEC 1000-2-2: 1990, *Electromagnetic compatibility (EMC) – Part 2: Environment – Section 2: Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems*

IEC 1000-4-1: 1992, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 1: Overview of immunity tests – Basic EMC publication*

IEC 1008-1: 1990, *Residual current operated circuit-breakers without integral overcurrent protection (RCCBs) – Part 1: General rules*
Amendment 1 (1992)

IEC 1009-1: 1991, *Residual current operated circuit-breakers with integral overcurrent protection (RCBOs) for household and similar uses – Part 1: General rules*

CISPR 14: 1993, *Limits and methods of measurements of radio disturbance characteristic of electrical motor-operated and thermal appliances for household and similar purposes, electric tools and electric apparatus*

3 Standard electromagnetic environmental conditions

Standard electromagnetic environmental conditions are those conditions which occur in installations connected to low-voltage public networks or similar.

3.1 *Low-frequency electromagnetic phenomena*

Table 1 lists the low-frequency electromagnetic phenomena considered under the environmental conditions taken into account.

Table 1

Reference	Phenomena	Environmental conditions
T 1.1	Harmonics, interharmonics	With levels of harmonics and interharmonics according to IEC 1000-2-2
T 1.2	Signalling voltages	In presence of signalling voltages (without resonance)
T 1.3	Voltage amplitude variations	Between 0,85 and 1,1 U_n and possible voltage dips of short duration or voltage interruptions [1]
T 1.4	Voltage unbalance	Refer to IEC 1000-2-2
T 1.5	Power frequency variations	Within normal frequency deviation range of ±5 %
T 1.6	Induced low frequency voltges	Not applicable
T 1.7	Direct current in a.c. network	Without appreciable direct current component
T 1.8	Radiated magnetic field	Vicinity of low-voltage power line

[1] Voltage dips are occasional voltage drops greater than 15 % of U_n and less than 100 % of U_n. Typical values of these dips are 30 % to 50 % of U_n. Short voltage interruptions are voltage drops of 100 % of U_n. The duration of these dips and short interruptions may be of more than half a cycle up to about 1 s.

3.2 *High-frequency electromagnetic phenomena*

Table 2 lists the high frequency electromagnetic phenomena considered, whether conducted, induced or radiated, whether continuous or transient, under the environmental conditions taken into account.

Table 2

Reference	Phenomena	Environmental conditions
T 2.1	Conducted oscillatory voltages or currents	Refer to 2.5
T 2.2	Conducted unidirectional transients of the nanosecond time scale (burst)	Low-voltage installations
T 2.3	Conducted unidirectional transients of the micro-/millisecond time scale	Overhead and underground networks with possible distant lightning at less than 1 km from the installation
T 2.4	Current oscillatory transients	Switching overvoltages or indirect lightning
T 2.5	Radiated high-frequency phenomena	Less than 10 V/m (e.g., radio, television stations at a distance over 1 km, portable transceivers not closer than 1 m)

3.3 *Electrostatic discharges*

Table 3 gives the electrostatic discharge phenomenon considered, under the environmental conditions taken into account.

Table 3

Reference	Phenomena	Environmental conditions
T 3.1	Electrostatic discharges	Possible presence of electrostatically charged materials (for example, synthetic carpets) at low humidity

4 Electromagnetic emission of RCDs

Emission tests are required only for RCDs containing a continuously operating oscillator. They shall be carried out according to CISPR 14.

NOTES

1 RCDs other than those containing a continuously operating oscillator do not usually generate continuous or transient disturbances except during their switching process. The frequency, the level and the consequences of such emissions are considered as part of the normal electromagnetic environment of low-voltage installations.

2 RCDs containing microprocessors are not considered.

5 Electromagnetic immunity of RCDs

Unless otherwise stated the tests are made without load.

5.1 *Performance criteria*

For the purpose of this standard the performance criteria of the IEC 1000 series are replaced by 5.1.1, 5.1.2, 5.1.3 and 5.1.4. For safety reasons, some tests levels and test specifications have been chosen at levels higher than those required by the standard of the IEC 1000 series.

5.1.1 During the test making reference to this performance criterion, the RCD shall remain closed at continuously applied residual current of 0,3 $I_{\Delta n}$ and shall trip at 1,25 $I_{\Delta n}$.

5.1.2 During the tests making reference to this performance criterion the RCD shall not trip. After the test, compliance with item a) of 9.9.2.3 of IEC 1008-1 at $I_{\Delta n}$ only shall be checked.

5.1.3 During the test making reference to this performance criterion the RCD may trip. After the test, compliance with item a) of 9.9.2.3 of IEC 1008-1 at $I_{\Delta n}$ only shall be checked.

5.1.4 Other performance criteria are contained in the clauses of the product standards, for example IEC 1008-1 and/or IEC 1009-1.

5.2 *Low-frequency immunity tests*

The data for the low frequency immunity tests to be applied are given in table 4.

Table 4

Reference (see table 1)	Electromagnetic phenomena	Reference of basic standard for test description	Test level and test specification	Subclauses including the performance criteria
T 1.1	Harmonics, interharmonics	Under consideration		
T 1.2	Signalling voltages	Under consideration		
T 1.3	Voltage amplitude variations [1]			
	Voltage fluctuations [2]	9.9.5 and 9.17 of IEC 1008-1 9.9.1.5 and 9.17 of IEC 1009-1	From 0,85 U_n to 1,1 U_n [3]	9.16 and 9.17 of IEC 1008-1 and IEC 1009-1
	Voltage dips [2]	9.17 of IEC 1008-1 of IEC 1009-1		
	Voltage interruptions [2]	9.17 and IEC 1008-1 of IEC 1009-1		
T 1.4	Voltage unbalance	Refer to 1.3		
T 1.5	Power frequency variations	[4]		
T 1.8	Radiated magnetic field [2]	9.11 and 9.18 of IEC 1008-1 /(RCCBs) 9.12 and 9.18 of IEC 1009-1/ (RCBOs)		

[1] The functioning of RCDs functionally independent of line voltage is not affected by voltage amplitude variations. The tests of this section apply only to RCDs dependent on line voltage.

[2] For the purpose of this standard, the relevant test of the product standard are used to cover the EMC requirements.
Tests specified in product standards need not be repeated.

[3] For PRCDs 0,7 U_n instead of 0,85 U_n.

[4] Immunity from power frequency variations is ensured by the fact that all performances of the device are tested at frequencies which may be subject to variations in the range of ±5 % of the rated frequency: see 9.2 of IEC 1008-1 and IEC 1009-1.

5.3 *High-frequency immunity tests*

The data for the high frequency immunity tests to be applied are given in table 5.

Table 5

Reference (see table 2)	Electromagnetic phenomena	Reference of basic standard for test description	Test level and test specification	Subclauses including the performance criteria
T 2.1	Conducted oscillatory voltages or currents	Under consideration according to IEC 1000-4-6		5.1.1
T 2.2	Fast transients (bursts) Common mode	IEC 801-4 [2]	Level 4: 4 kV (peak) Tr/Th 5/50 ns Repetition frequency: 2,5 kHz [5]	5.1.2 [3]
T 2.3	Conducted unidirectional transients of the micro-/millisecond time scale	Under consideration according to IEC 1000-4-5	Tr/Th 1,2/50 µs 5 kV (peak) [1] common mode 4 kV (peak) [1] differential mode	5.1.2 [1]
T 2.4	Current oscillatory transients (ring wave)	9.19 of IEC1008-1 and IEC 1009-1	0,5 µs / 100 kHz 200 A (peak) [4]	5.1.4
T 2.5	Radiated high-frequency phenomena	Under consideration according to IEC 1000-4-6		5.1.1

[1] This test shall be carried out on the RCD, in the closed position:
- between the metal support and parts intended to be earthed (PE conductor, earthing terminal), if any, connected together, and all live parts connected together at an impulse voltage of 5 kV (4 kV for SRCDs and PRCDs) and an impedance of 12 Ω;
- between each phase and neutral, in turn, and between each couple of poles, in turn, at an impulse voltage of 4 kV (2 kV for SRCDs and PRCDs) and an impedance of 2 Ω.

For SRCDs and PRCDs the performance criterion is given in 5.1.3.

[2] In addition, the sample shall be mounted according to figure 15 or 16, as relevant, of IEC 1008-1, using a steel sheet of thickness 1,6 mm.

[3] The test is carried out as a single-phase test on one pole of each sample, taken at random.
Three new samples are submitted to the test. If one sample does not comply with the criterion by tripping during the test, three further samples are tested, which shall fully comply with criterion of 5.1.2.

[4] For SRCDs and PRCDs the current level is at present 25 A.

[5] For SRCDs and PRCDs the level is 3, i.e. 2 kV (peak).

5.4 *Electrostatic discharges*

The data for the electrostatic discharge test to be applied are given in table 6.

Table 6

<table>
<tr><th>Reference (see table 3)</th><th>Electromagnetic phenomenon</th><th>Reference of basic standard for test description</th><th>Test level and test specification</th><th>Subclauses including the performance criteria</th></tr>
<tr><td>3.1</td><td>Electrostatic discharges</td><td>IEC 801-2</td><td>Level 3</td><td>5.1.3</td></tr>
<tr><td colspan="5">Three new samples are submitted to the test. All three shall pass the test.
The point to which discharges shall be applied is selected by an exploration of the accessible surfaces of the RCD, when installed as for normal use. The selection is made with 20 discharges per second.</td></tr>
</table>

(Continued from second cover)

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 1008-1 : 1990 Residual current operated circuit-breakers without integral overcurrent protection (RCCBs)—Part 1: General rules	12640 : 1988	Technically equivalent
IEC 1009-1 : 1991 Residual current operated circuit-breakers with integral overcurrent protection (RCBOs) for household and similar uses—Part 1: General rules	Nil	—
CISPR 14 : 1993 Limits and methods of measurements of radio disturbance characteristic of electrical motor operated and thermal appliances for household and similar purposes, electric tools and electric apparatus	6873 (Part 2) : 1978	Technically equivalent

Only the English language text in the International Standard has been retained while adopting it in this Indian Standard.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards Monthly Additions'.

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 323 01 31, 323 33 75, 323 94 02

Telegrams: Manaksanstha
(Common to all offices)

Regional Offices:

		Telephone
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	323 76 17, 323 38 41
Eastern	: 1/14 C.I.T. Scheme VII M, V.I.P. Road, Maniktola CALCUTTA 700054	337 84 99, 337 85 61 337 86 26, 337 91 20
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